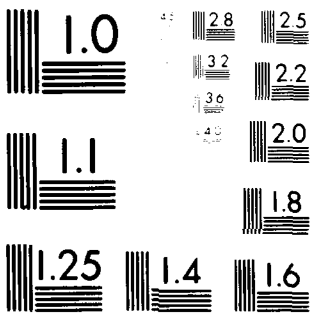
AD-A098 648 VIRGINIA UNIV CHARLOTTESVILLE DEPT OF PHYSICS F/G 20/3
TRAPPED ION RESEARCH. SUMMARY QUESTIONNAIRE.(U)
APR 81 D J LARSON N00014-78-C-0772

UNCLASSIFIED NL

1 OF 1
AD A
098648

END
DATE
FILMED
6-81
DTIC



MICROCOPY RESOLUTION TEST CHART

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A098648	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Summary Questionnaire Trapped Ion Research		5. TYPE OF REPORT & PERIOD COVERED Interim 4-25-80 to 4-30-81
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Daniel J. Larson		8. CONTRACT OR GRANT NUMBER(s) N00014-78-C-0772
9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of Physics University of Virginia Charlottesville, VA 22901		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research Arlington, VA 22217		12. REPORT DATE 4-30-81
		13. NUMBER OF PAGES 3
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

LEVEL II

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; Distribution unlimited

DTIC ELECTE MAY 8 1981 D

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

frequency standards, high resolution spectroscopy, trapped ions, microwave transitions, negative ions, laser spectroscopy, photodetachment.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

High resolution spectroscopy of trapped negative ions is being pursued. Microwave transitions have been observed in S^- ions. The g_J-factor of ground state S^- ions has been measured. Laser and wavelength measurement improvements have been implemented. Such spectroscopy is potentially applicable to improved frequency standards.

81 5 07 005

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Office of Naval Research Contract #N00014-78-C-0772

Trapped Ion Research

Summary Questionnaire

1) Principal Investigator: Daniel J. Larson, University of Virginia

2) Contract Description: High resolution spectroscopy of trapped ions, especially negative ions, is being pursued. Such spectroscopy is potentially applicable to improved frequency standards.

3) Scientific Problem:

While ion traps hold great promise for ultra precision spectroscopy, only a few examples have been experimentally investigated. Many questions remain about appropriate means of confinement, cooling, and probing of various species. In addition, the ideas about the suitability of different ions as systems to test various scientific and technical concepts are not fully developed.

4) Scientific and Technical Approach:

This work has centered on the use of negative ions. State selection can be done with high efficiency by using state dependent photodetachment both as a preparation and as a probe of bound state transitions. Negative ion photodetachment provides basic information which complements work on photoionization of neutral atoms and molecules.

5) Progress:

Substantial advances have been realized in the past several months. Some of these are just beginning to have an impact on the central experimental program. Most significant is the measurement of the g_J-factor in the $^2P_{3/2}$ ground state of S^- to a precision of about 20 ppm.

The linewidth of the S^- Zeeman resonances is surprisingly large. We have tested for the effects of magnetic field inhomogeneity, laser

5) (continued)

power, microwave power and ion number. The most likely candidate is the magnetic field. An improvement in the field was responsible for the linewidth reduction from preliminary measurements. The signal to noise is about as good as can be achieved. The state selective photodetachment technique which correlates the internal ion state with its presence in the trap and the ion detection scheme which operates with high sensitivity together approach the maximum possible detection efficiency for internal transitions. The ideal detector sorts the ions according to internal state and counts them without error. The measurements do not yet approach the ideal in terms of frequency error in a given measurement time because the Zeeman resonances are broadened by a non-fundamental (presumably magnetic field) effect. Looking at transitions with lower magnetic field dependence such as those available in $^{33}S^-$ should help determine the source of broadening and get much closer to the fundamental limits on frequency error.

A traveling Michelson interferometer with a stabilized He-Ne laser reference has been constructed and used in a precision measurement of the S^- photodetachment threshold. Also a ring dye laser has been built and operated. This produces more power in the visible and allows the possibility of generation of CW UV light for further experiments.

6) "Optically Probed microwave Resonances in Negative Ions", R. M. Jopson and D. J. Larson, Seventh International Conference on Atomic Physics, Abstracts, p. 275 (1980).

"Measurement of g_J in S^-", R. M. Jopson and D. J. Larson, Bull. Am. Phys. Soc. 25, 1133 (1980).

"Optically Probed Microwave Resonances in Negative Ions", Opt. Lett. 5, 531 (1980).

"Experimental Determination of the Magnetic Moment of the Negative Sulfur Ion", R. M. Jopson and D. J. Larson, submitted to Phys. Rev. Lett. (1981).

7) Extenuating Circumstances:

None

8) Unspent Funds: None expected

9) Graduate Students Receiving Degrees: R. M. Jopson, Ph.D., Harvard U., June, 1981, C. Edge, M. S., University of Virginia, 1981.

10) Other Support:

The principal investigator is presently supported by a grant from the National Science Foundation at a rate of $53,000/year. This is primarily for the support of research on atomic and nuclear structure in high magnetic fields.

April 30, 1981

DAT
FILM